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# The Relative Age Effect on Labour Market Outcomes – Evidence from Italian Football

**Research question:** This study investigates whether the relative age effect (RAE) persists in the long-term and affects Italian-born footballers' performance and wages. **Research methods:** A unique dataset on 1,700 individual players' remuneration and performance was collected and analysed through the chi-square goodness-of-fit, the Spearman rank correlation, and an econometric model. **Results and findings:** This study contributes to the literature by providing clear results on long-term RAE. We find evidence of the RAE in terms of representativeness, which means that, in an age-group, players born relatively early are over-represented, while those born relatively late are under-represented, even accounting for national birth trends. Moreover, although they perform similarly, the gross wages of players born relatively late are statistically significantly lower than those of players born relatively early. **Implications:** This situation needs to be considered by various football stakeholders and tackled accordingly to minimize the loss of potential youth football talent. Further research is needed to identify the determinants of RAE in the long-term.

## **Introduction**

In any sport age-group or team, some children are relatively older than others. This is mirrored by maturity gaps (Musch & Hay, 1999), which cause performance gaps, commonly known as the relative age effect (RAE). The presence of the RAE is characterized by a skewed birthdate distribution, which reflects differences in physical sizes, cognitive abilities, and maturity. Because of this, children born late in sports admission years are expected to be systematically disadvantaged throughout childhood and up to their late teens.

The RAE operates early in development—when the relative age differences found in an age-group are at their highest—and evolves over time (Cobley et al, 2009; Musch & Grondin, 2001). Although there is a general consensus about the fact that individual athletes' characteristics, their developmental environments, and the sport itself are all relevant factors in the evolution of the RAE, the extant literature is mostly atheoretical and fails to describe the complexity of this phenomenon (Wattie et al., 2015). Only two approaches attempt to theorize RAE evolution.

First, considering the individual and environmental factors that influence athlete participation and following Newell's framework (Newell, 1986), Wattie et al. (2015) suggested a heuristic developmental systems theory (DST) grounded on a constraints-based model for the RAE in sport. This theoretical model is built upon three interacting developmental constraints: i) individual (i.e., birthdate), ii) task (e.g., type of sport and level of competition), and iii) environmental (e.g., the cultural popularity of a sport and its policies and developmental systems). All these constraints, which are at the base of the RAE, are, however, ineffective if they are not integrated and interacting within a developmental system. From the moment relative age differences are present within a system (i.e., a sport), they begin to affect it and, over time, they can influence its development and the behaviour of its actors, such as families and coaches. The model also includes the principles of diversity

(inter-individual differences in development) and plasticity (potential for change), which are both highly relevant to the RAE. Specifically, young athletes experience different developmental trajectories based on their individual characteristics and the interaction of various individual constraints with equally diverse task and environmental ones. However, although there is an inherent diversity in maturation growth, relatively younger children can potentially have a developmental plasticity that is comparable to that of relatively older ones. These principles establish the probabilistic nature of the RAE and the fact that some relatively younger athletes are selected for youth sports teams.

Second, considering the RAE as a social construct, social agents—such as parents (Hancock et al., 2013), coaches (Musch & Grondin, 2001), and athletes (Cobley et al., 2009)—play relevant roles (Gutierrez Diaz Del Campo et al., 2010; Hancock et al., 2013; Thompson et al., 2004) as they interpret physical maturity as talent (Sherar et al., 2007; Till et al., 2011). Hancock et al. (2013) theoretically conceptualized such roles in determining the presence and procrastination of the RAE based on three distinct and interrelated effects: the Matthew, Galatea, and Pygmalion effect. The Matthew effect involves parents encouraging relatively older children to take up sports more frequently than relatively younger ones (Delorme et al. 2011). This situation provides coaches with a talent pool that is skewed in favour of relatively older athletes. Additionally, relatively older children directly support the RAE through the Galatea effect: they tend to be more diligent while training if they perceive themselves as being more gifted (Hancock et al., 2013). Finally, coaches and parents indirectly support the RAE through the Pygmalion effect: they have high expectations for relatively older athletes because they believe them to be more skilled; thus, they provide these athletes with high encouragement to train. Hence, the RAE is pushed from both the coach and parent sides and it can be extended to the professional level in the long-term.

The RAE could persist well into adulthood and affect labour market outcomes: different childhood performances, leading to the acquisition of different learning opportunities and skills, affect later personal development (Cunha & Heckman, 2007). For this reason, we investigate the possible persistence of long-term RAE within the context of Italian professional football in terms of professional players' representativeness, performance, and wages, which, to the best of our knowledge, have not been investigated simultaneously in earlier studies. This enables us to more clearly assess the RAE on players' performance and earnings. As selection of players is based on perceived skills, the presence of an RAE in terms of representativeness should also imply an RAE in terms of individual players' outcomes—such as performance and wages—which is what we investigate in the following sections. The remainder of the paper proceeds as follows. Section II presents a summary of the literature review on the RAE in football; Section III discusses the data, the empirical methodology, and the results; Section IV concludes.

### **Evidence of the Relative Age Effect: the Extant Literature**

A vast literature provides evidence for a negative RAE in sports. The RAE appears to be largely found among males and to be more pronounced in elite sports, most likely because of the need to select the best players in order to compete in international sports (Glamser & Vincent, 2004; Vincent & Glamser, 2006). As statistics on youth competitions are scarce, the RAE in childhood sports is studied in terms of representativeness, which produces results that are in line with those from studies on adult athletes. The selection of players is based on performance, so the best performers continue practicing their sport while others drop out; because of the relative age difference, a large percentage of best performers are born early in the admission year: this result is usually observed in the specialized sports literature (Helsen et al., 1998; Williams, 2010).

There is large empirical evidence on the RAE in football. In terms of representativeness, the RAE has been widely researched since the early 1990s, when Barnsley et al. (1992) were the first to analyse this effect focussing on the 1990 Under-20 and Under-17 FIFA World Cups. Later, numerous studies assessed this phenomenon in several competitions at both the youth and professional levels in various countries: the Netherlands (Dudink, 1994), England (Verhulst, 1992), Belgium (Vaeyens et al., 2005), Germany, Japan, Brazil, Australia (Musch & Hay, 1999), France (Delorme & Raspaud, 2009), Spain (Salinero et al., 2013), and Ireland (Butler & Butler, 2015). More specific and recent studies have confirmed the presence of the RAE in relation to the geographical areas designated by FIFA (Williams, 2010) and to the type of competition, such as the UEFA Champions League (Gonzalez-Villora et al., 2015). In youth football, the RAE tends to be greater in younger age-groups than it is in older ones (Mujika et al., 2009). In professional football, the RAE persists because of intense competition and tough selection mechanisms (Cobley et al., 2008; Toledo et al., 2012). Research on the RAE has been also conducted in relation to players' roles, revealing that those born in early part of the year are over-represented among defenders and midfielders (Salinero et al., 2013). Finally, as with the case of football, popularity and media coverage are important factors in the emergence of the RAE together with high competition for playing opportunities (Wattie et al. 2007).

Despite these premises, the empirical consensus on the long-term RAE in the sports labour market—measured in terms of representativeness, performance, and wages—is not significant due to the limited number of studies hitherto conducted. Only two studies, Ashworth and Heyndels (2007) and Bryson et al. (2014), conducted an empirical analysis on the RAE in terms of both representativeness and players' remuneration. The first study investigated the presence of the RAE among German professional footballers during seasons 1997-98 and 1998-99 and its potential impact on their remuneration. The empirical results

supported the existence of the RAE and found that players born late after the cut-off date earned systematically more. The main limitation of this study was its time span: only two years and immediately after the Bosman ruling, when the football transfer market was not fully internationally developed as it is nowadays. The second study analysed NHL players' performance as a function of their relative age over 18 seasons—from 1990 to 2008. The empirical evidence suggests that positive selection and peer effects could positively affect relatively younger players' performance and wages. In both studies, a reverse RAE in terms of wages—i.e., with relatively younger athletes receiving higher wages—was combined with a RAE in terms of representativeness—i.e., with relatively older athletes being over-represented.

Our study on RAE in the Italian football relies on two premises. First, information on footballers' salaries is not easily available as it is not usually revealed by football associations, leagues, and clubs. For this reason, most studies focussing on players' remuneration are mainly localised in the North American MLS, the German Bundesliga, and the Italian Serie A, as media from those countries usually collect and publish these data; however, studies on European leagues usually investigate limited time spans. Secondly, football players' performance is usually measured with a subjective grade system or through individual performance statistics—such as goals scored and assists—that are not consistent role by role and do limit the effectiveness of the empirical analysis. As we explain in the following section, both these limitations are overcome by our dataset.

### **Institutional Context and Data**

The empirical setting for our analysis is the Serie A, the major Italian professional football league, which is currently composed of 20 teams. At the end of each season, the bottom three teams are relegated to the Serie B, the second tier professional football league, and replaced by the top three teams in the latter. The relevance of players' age in Serie A is

well established. According to CIES (2016), among the 31 European top football divisions, Serie A players recorded the highest average age—circa 27 years old—over the six football seasons since 2009. This evidence highlights age as a critical factor to be considered by Italian Serie A clubs as they have the lowest quantity of club-trained players. Hence, the Serie A is not the best league in terms of favouring the emergence of young football talent, as professional clubs rely more on older and more experienced players.

The Italian age-group system is strictly regulated. January 1<sup>st</sup> is the relevant admission date applied to each youth category. Professional teams can sign footballers as young as 16 (art. 33, Internal Organization Rules FIGC).

Our dataset contains information on Italian-born footballers from seven consecutive Serie A seasons—2007-08 to 2013-14. This involves observations on 507 Italian-born footballers who played for at least one Serie A team during these seven seasons. In total, our dataset contains 1,704 football-season observations on Italian-born players; while most footballers appear in the dataset for no more than one or two seasons, some appear for up to seven.

It is hard to keep track of youth category rules for different countries. These are written in the local language, are not easily accessible and vary both between countries and within countries over time. Although most countries currently share the same cut-off date—i.e., January 1<sup>st</sup>, until the 90s, many countries had different cut-offs (for Belgium, Helsen et al., 2000; for Germany, Ashworth & Heyndels, 2007; for Great Britain, Bryson et al., 2014; for Ireland, Butler & Butler, 2015); thus, many foreign players in our dataset may have trained under different age-group rules. Therefore, we decided not to assume age-group system uniformity and to focus only on Italian-born players.

Our data are extremely rich. We combine information on players' birth dates with births in Italy from 1965 to 1995 and the Italian monthly birth rates over the same period to



investigate the RAE on representativeness. Data on Italian births were retrieved from Eurostat's demographic dataset (Eurostat, 2017). For the empirical analysis of the RAE on performances and wages, we use information on players' quarter of birth and other personal details: age, seasonal tangible performance measured by the IVG (index of general evaluation), players' yearly wages and teams. **IVG data were provided by Panini Digital, the official Serie A data provider; this index represents a concise and objective measurement of a players' performance based on statistics collected through a constant monitoring software-based system of players' and teams' performance (Bacconi & Camillo, 2000). Performance indicators were selected for all of the four fundamental playing roles. Through the use of mathematical and statistical models that correlate frequent events (e.g., restarts, passes, dribbles) with rare ones (e.g., goals scored and conceded, assists, red cards), the IVG system monitors players' performance and estimates the likelihood of rare and fundamental events happening within seconds during a football match. The values obtained are compared with the expected ones, that are based on role-specific historical measures. The IVG is expressed on a scale of 30.** Data on wages were obtained from annual reports compiled by Italy's sports newspaper 'La Gazzetta dello Sport'. All other players' demographic information was collected from the website Soccerassociation.com. Wages are before taxes and do not include any bonus, image right, or other deals; they are deflated to the 2013 price level based on deflation coefficients retrieved from the Italian National Institute for Statistics (ISTAT, 2017). Table 1 reports the descriptive statistics and pairwise correlation between these variables, except for season and team dichotomous variables.

[Table 1 near here]

As Ashworth and Heyndels (2007) explained, when we investigate the RAE on wages, the inclusion players' performance (here, the IVG) in an econometric regression could cause multicollinearity. However, this table shows a lack of correlation between the IVG and Serie

A footballers' quarters of birth; therefore, when we fit a regression for individual wages on the RAE, we can control for performance.

## **Methods and Results**

### ***The RAE in Terms of Representativeness***

In the presence of an RAE, the observed distribution of quarterly birth rates should differ from the expected one. Players born at the beginning of an admission year should be over-represented, while those born at the end should be under-represented. Moreover, the birth rate should decrease moving away from the admission date; this result should hold even when trends in the general population birth rate are accounted for. This is due to the fact that relatively older players are often perceived as more talented in their early ages and are streamed to better teams more frequently than relatively younger peers (Allen & Barnsley, 1993).

To analyse the RAE in terms of representativeness, we implement two tests. First, a chi-square goodness-of-fit test to compare the observed and expected numbers of players across quarters, with observations from the seven seasons being pooled. The expected number of players is based on Italy's average quarterly birth rates between 1965 and 1995. We do not assume a uniform birth rate distribution because of the seasonality of births that characterizes the general Italian population (Rizzi & Dalla Zuanna, 2007). Second, the Spearman-rank correlation coefficient is computed to measure the correlation between two measurement variables, which are converted to ranks; one variable is the *quarters' representativeness*, which is based on the differences by quarter between the expected number of players (E) and the observed number of players (O). First place in the ranking is assigned to the most under-represented quarter, while last place is assigned to the most over-represented one. The second variable represents the *admission date distance* and is a proxy for relative age. It is based on the distance of the quarter from the admission date; thus, January-March has first position in

the ranking, whereas October-December has fourth position. Table 2 reports the results for both tests.

[Table 2 near here]

The chi-square test provides statistically significant evidence that the observed quarterly birth rate distribution of Italian-born footballers differs from the expected one. The pairwise chi-square, with Bonferroni-adjusted p-values, is used as post-hoc test; the results are displayed in Table 3, and show that each difference is highly statistically significant.

[Table 3 near here]

The “Difference (E)-(O)” column suggests the existence of a specific trend in the players’ average quarterly birth rate that is compatible with the RAE in terms of representativeness. Players born at the beginning of the admission year are over-represented, and players’ representation decreases moving from the first to the last quarter of the year.

The formal analysis of the existence of this specific birth rate trend is implemented using the Spearman-rank correlation coefficient, as in Musch and Hay (1999) and Ashworth and Heyndels (2007).

Table 2 reports a highly statistically significant and negative correlation between quarters’ representativeness and admission date distance.

When these two analyses are repeated while considering only one observation per player—see Table A.1 in the Appendix—the results are confirmed. Table A.2 repeats the post-hoc test on this sub-sample; each difference is highly statistically significant, except for Q2 vs Q3, which is significant at the 5 percent level.

Additionally, we conduct a chi-square test to compare the distributions of players’ birth quarters between the ages of 17 (the minimum age) and 25, and between the ages of 30 and 43 (the maximum age). We find evidence for the under-representation of relatively young players being less pronounced at older ages. However, we refrain from interpreting this

difference as evidence of a longer career for players born later in the year; it may be due to an increase in the RAE on admissions to professional football over time. These results can be provided upon request.

### ***The RAE in Terms of Individual Players' Outcomes***

We turn our attention to the RAE on players' performance and wages. The empirical investigation of performance and wage gaps proceeds with the ordinary least square (OLS) regression, as in Ashworth and Heyndels (2007). Based on the available data, we specify the OLS as follows:

$$\text{Outcome}_i = \beta_0 + \beta_1 \text{age}_i + \beta_2 \text{age}_i^2 + \beta Q + \beta S + \beta T + \varepsilon_i \quad (1)$$

The outcome is either the IVG or the deflated yearly gross wage of individual  $i$ . Since the distribution of wages is positively skewed because of the presence of superstars (Adler, 1985; Rosen, 1981), we apply a natural logarithmic transformation. The first set of control variables includes  $\text{age}_i$  and  $\text{age}_i^2$ , with the latter capturing decreasing returns to age. Age is rescaled by subtracting its minimum value in the sample, i.e. 17. The age squared variable is standardized to decrease its correlation with age. Vector  $Q$  contains variables of interest—i.e., dummies for quarter of birth—where the first quarter of the admission year (January – March) is the reference quarter; the estimated coefficients for these dummies represent the RAE. Additionally, we include season fixed-effects; i.e., vector  $S$ . Finally, we include team fixed-effects; i.e., vector  $T$ . Season and team fixed-effects capture heterogeneous unobservable characteristics. Because we use repeated observations on individual players, standard errors are clustered on footballers. This method allows for heteroscedasticity and for the variance of the error term to be the same within players.

This OLS specification differs from that of Ashworth and Heyndels (2007) in two ways. First, dummies for players' roles are excluded from the set of independent variables, since there is evidence that players' role is affected by relative age both in Italy and in other

European countries (Salinero et al., 2013). Second, we do not have a measure of experience for all seasons in our dataset.

We conduct a robustness check on a discontinuity sample (Ponzo & Scoppa, 2014; Black et al. 2011). This strategy involves focussing on a narrower sample composed of footballers born in either of the two adjacent months, January and December, around the admission date. Therefore, season-of-birth effects should be eliminated.

Season-of-birth effects are unrelated to within-age-group maturity differences, and thus to the RAE. They explain performance gaps between people born in the same calendar year, but in different periods. They are due to climatic, environmental, sociocultural, and biological factors (Musch & Grondin, 2001) and, if not accounted for, they can bias the RAE estimates. On one hand, when the beginning of the admission year coincides with a period of the calendar year that conveys advantages due to season-of-birth effects, the RAE estimate is likely upwards biased (Musch & Hay, 1999; Helsen et al., 2012). On the other hand, the estimate could be downwards biased if the later months of the selection year coincide with a period of the calendar year that conveys advantages to people born within it (Buckles & Hungerman, 2013).

Model (1) potentially leads to unbiased RAE estimates for performance and wages for three reasons. Firstly, previous studies (Musch & Hay, 1999; Helsen et al., 2000) have suggested that season-of-birth has no substantial effect on footballers' performance. Secondly, the Italian age-group system is strictly regulated and forbids the voluntary deferral of entry into a particular youth category; thus, we do not expect our estimates to be affected by the presence of heterogeneous ages within age-groups. Finally, in Italy, there seems to be no correlation between date of birth and family socioeconomic status (Ponzo & Scoppa, 2014); this is a specific type of season-of-birth effect. These are all common confounders of RAE estimates.

### *The RAE on performance*

Table 4 reports the results from the analyses of the RAE on performance and does not provide evidence for any such effect. Hence, we can use players' tangible performance IVG as a control variable in the analysis on wages without any issue of multicollinearity.

[Table 4 near here]

### *The RAE on wages*

Table 5 reports the results from the analyses of RAE on wages. The estimates in columns (1) to (3) provide statistically significant evidence of a negative RAE on wages. All else equal, players born in the fourth quarter of the admission year receive wages that are approximately 19 percent lower than those earned by footballers born in the first quarter. Because of the logarithmic transformation of the outcome variable, the per cent interpretation is obtained by:  $[\exp(\text{estimated } \beta) - 1] * 100$ . The estimates obtained from the discontinuity sample confirm this result, see column (4). Moreover, these estimates suggest that players born in December are even more affected by the RAE: all else equal, their wages are on average 44.6 percent lower than those of older peers.

[Table 5 near here]

We obtain equivalent results when we conduct regressions that include cohorts in lieu of age and cohort specific numbers of births in the Italian general population, which is intended to proxy potential competition.

Finally, we re-analyse the data with the quantile regression at the 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup> and 90<sup>th</sup> percentiles of the wage distribution. We do that for two reasons: i) this regression model drops the assumption that the RAE is the same at the tails of the wage distribution as it is at the mean; ii) the estimates at the median can be used as a further robustness check. The results show that players born in the fourth quarter of the admission year receive wages that are approximately 13, 10, 11, and 17 percent lower than those earned by footballers born in the

first quarter, respectively at the 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup>, and 90<sup>th</sup> percentiles. These estimates, which can be provided upon request, confirm the existence of a negative RAE on wages, and suggest that the RAE might be stronger at the extremes of the wage distribution. Moreover, we note that players born in the second quarter seem to suffer from a negative RAE in the top percentiles of the wage distribution, suggesting a possible non-linear RAE.

*The RAE on wages, controlling for performance*

To improve the interpretation of these results, we fit the regression on wages a second time and add the IVG lag as a control variable, to control for how performance in year t-1 affects wages in year t. The results are shown in in Table 6.

[Table 6 near here]

The results show that relatively young players are paid less even when we account for their tangible performance.

If we combine this result with that on the RAE on performance, we conclude that, Italian-born football players born in different quarters are compensated differently even when they perform similarly. This is the first time this result is illustrated in the RAE literature and is robust to different specifications.

The reader should note the non-linearity of the RAE in the Serie A. Only the expected wages of players born in the final quarter are lower than those of players born in the first quarter; the RAE on wages does not show itself gradually but only when the difference in relative age reaches its maximum. Further, this result could be driven by wage differences between players born in January and December; with the population of players born in December being small.

As a further robustness check, we re-conduct the analysis on the restricted sample of players who had signed new contracts. This sample is notably smaller; thus, the analyses do

not provide statistically significant results. However, both the direction and magnitude of the RAE are confirmed.

*The RAE on wages, controlling for performance, by age category*

Wage disparities between the youngest players, in terms of absolute age, may drive these results. To test this possibility, we repeat the analysis with the latter model specification (i.e., with the IVG lag) on different sub-samples based on three age categories: i) from 17 to 25, ii) from 25 to 30, and iii) from 30 to 43. Table 7 shows the results.

[Table 7 near here]

The figures in this table suggest that wage disparities might decrease with the increase in absolute age. All else equal, at the beginning of their professional careers, players born in the fourth quarter receive wages that are approximately 47 percent lower than those earned by footballers born in the first quarter. This gap decreases to almost 34 percent at the core of their careers and to almost 28 percent at their end. Therefore, in the Serie A, although greater experience seems to reduce the RAE on wages, it does not eliminate it. The analysis of the discontinuity sample cannot be conducted because the sub-samples are too small. Similar results are obtained without controlling for lagged IVG.

Alternatively, this analysis is also conducted by examining the interaction of absolute age with birth quarter instead of investigating different age-based sub-samples. We prefer the specification in Table 6 over the interaction of RAE with age for a specific reason: it enables us to investigate non-linear RAE in age, while shielding us from obtaining estimates that would be diluted by the low amount of observations available at very early ages. In fact, estimates based on the latter specification do not provide statistically significant results.



## Discussion and Conclusions

This paper focusses on two aspects of the long-term RAE on Italian-born professional football players. First, it investigates whether players born at the beginning of an admission year are over-represented. Second, it investigates a possible RAE on performance and wages.

This study provides statistically significant evidence for the RAE in terms of representativeness, with relatively older players being over-represented in the Serie A. The analyses also show that such over-representation wanes and turns into under-representation towards the end of the admission year.

This paper does not find evidence of the RAE on performance, but finds statistically significant evidence of it on wages, with players born late in an admission year earning, on average, lower gross wages. The magnitude of the wage gap caused by the RAE is economically relevant and robust to different specifications, although it seems to be driven by the wage gaps that exist between players born in January and in December. On average, players born in the last quarter earn 19 percent less than those born in the first, while players born in December earn 44.6 percent less than those born in January. Furthermore, we obtain equivalent results when we fit the regression of wages on the RAE while also controlling for performance. Additionally, we find that wage disparities may decrease with increases in absolute age.

The existence of the RAE on wages—independently from performance—is a unique result in the RAE literature and can be explained in two non-mutually exclusive ways. First, the constant difficulties met by relatively young players could undermine some of their personal traits and result in a negative effect on *intangible performance*—e.g., leadership skills (Dhuey & Lipscomb, 2009)—which is not captured by our measure, as it pertains to *tangible performance*. Second, there could be self-esteem gaps (Thompson et al., 2004) that do not affect performance, but that could affect wage gaps through different behaviours

adopted by footballers when they bilaterally bargain their wages with their teams (Bryson et al., 2014). Both interpretations are supported by the strand of the literature that supports a negative RAE on non-cognitive skills (Pellizzari & Billari, 2012; Delorme et al., 2011; Duhey & Lipscomb, 2006; Thompson et al., 2004).

Are our results applicable to other countries? To improve the external validity of the results, we recommend that future studies investigate with econometric tools more heterogeneous and larger samples of footballers. In particular, we recommend the investigation of samples that feature variations in admission dates—either within a country over time (similarly to Helsen et al., 2000, and Butler and Butler, 2015, who used statistic tests) or between countries/regions. Although it is difficult to retrieve information on youth categories, richer data promise larger rewards in terms of external validity.

Our results on wage gaps contradict those in Ashworth and Heyndels (2007), the only other study on the RAE on footballers' wages, which was focussed upon the German major league. This may be due to three differences between the two studies. First, the Italian and German institutional contexts may differ (e.g., the selection criteria of their category systems might differ). Second, Ashworth and Heyndels (2007) considered a much shorter period of time; therefore, they could not account for how the RAE evolves over time. Third, Ashworth and Heyndels (2007) investigated the period immediately following the 1995 Bosman ruling, which affected the level of competition for entry into the Italian-born footballers' labour market because it removed limitations on the number of players from other EU countries and introduced free agency. The data used in this paper are more recent, so a longer period has passed, enabling the Bosman ruling to fully affect the footballers' labour market. Because this ruling affects players' competition, it is also expected to affect the RAE on wages.

The findings of this study raise certain theoretical and practical considerations. From a practical perspective, as talent detection and identification programmes may be biased by

differences in relative age, prevention strategies must be put in place in order to reduce the RAE in terms of representativeness. A revision of the age-grouping system could bring beneficial results; for instance, age-groups could be shortened to include only players born no more than six to nine months apart (Pellizzari & Billari, 2012; Barnsley & Thompson, 1988) to reduce within-age-group maturity differences. Other recommendations aimed at reducing the RAE could address annual age-groupings by rotating cut-off dates from year to year (Barnsley et al., 1985), and by grouping young athletes according to their physical classification (i.e., height and weight), similar to what is routinely done in boxing and wrestling. The integration of these strategies into sport systems may prove difficult, as they are still unproven (Cobley et al., 2009). A more realistic and less challenging solution could involve reconsidering the need for early selection, intensive training, and levels of representation at junior and child ages by delaying the related processes until after the stages of puberty and maturation (i.e., 15-16 years of age). This solution may reduce the RAE and the risk of burnout during athletes' development (Cobley et al., 2009). The introduction of birth quarter quotas may also be viewed as a mechanism suited to reduce the RAE by including a certain number of players from each quarter in a team in order for it to be allowed to participate in its age category. In general, the implementation of any solution would recommend that, to a certain degree, coaches and managers responsible for the organization of youth sport should be made aware that relative age causes disparities in physical attributes—such as height and weight—that lead to selection advantages for the relatively older players.

At the professional level, this paper also reveals the existence of the RAE on wages; this cannot be isolated from two main characteristics of Italian football in the last decade: having the oldest European top football division and the lowest level of club-trained players. Thus, relatively young talents face additional hurdles to flourish at top level and, if and when it does happen, they receive lower wages. In this context, some reform proposals have been

recently approved by the Italian football association—the Federazione Italiana Giuoco Calcio (FIGC)—with the aim of supporting the debut of young football talents in the Serie A. Since the 2015/16 season, each Italian professional football club has been listing a team roster composed of a maximum of 25 players older than 21. Within this roster, at least four of them must have been trained and have come through the youth academy of the club itself. Another reform currently under discussion looks at allowing top clubs to have a reserve team playing in the third division—i.e., the Lega Pro—similarly to what already happens in Spain. The Lega Serie A technical committee has explained that reserve teams in lower divisions would be an important tool for the growth and training of young players from top clubs. Under this proposal, clubs would be more likely to retain their own players, instead of loaning them out to other clubs, and still offering them the opportunity to play regularly—albeit at a lower level—but also leaving the door open for them to make senior team appearances. These two reforms could reduce the RAE by increasing the chances to access the Serie A. Also at this level, relative age quotas for such reserve teams may represent a mechanism to reduce the RAE. In general, against the theoretical background described in this paper, we would expect any policy aimed at reducing competition among young players to minimize the impact of the RAE.

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